ANALOG DEVICES

HMC797LP5E

v02.0811

RoHS✓ EARTH FRIENDLY

GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER, DC - 22 GHz

Typical Applications

The HMC797LP5E is ideal for:

- Test Instrumentation
- Microwave Radio & VSAT
- Military & Space
- Telecom Infrastructure
- Fiber Optics

Features

High P1dB Output Power: 28 dBm

High Psat Output Power: 29.5 dBm

High Gain: 13.5 dB

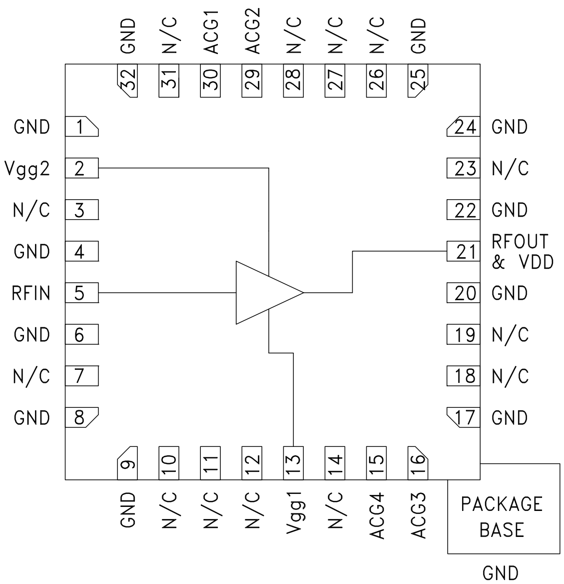
High Output IP3: 39 dBm

Supply Voltage: +10 V @ 400 mA

50 Ohm Matched Input/Output

32 Lead 5x5 mm SMT Package: 25 mm²

Functional Diagram



General Description

The HMC797LP5E is a GaAs MMIC pHEMT Distributed Power Amplifier which operates between DC and 22 GHz. The amplifier provides 13.5 dB of gain, 39 dBm output IP3 and +28 dBm of output power at 1 dB gain compression while requiring 400 mA from a +10 V supply. This versatile PA exhibits a positive gain slope from 4 to 20 GHz making it ideal for EW, ECM, Radar and test equipment applications. The HMC797LP5E amplifier I/Os are internally matched to 50 Ohms facilitating integration into mutli-chip-modules (MCMs), is packaged in a leadless QFN 5x5 mm surface mount package, and requires no external matching components.

Electrical Specifications, T_A = +25° C, Vdd = +10 V, Vgg2 = +3.5 V, Idd = 400 mA*

Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range		DC - 12			12 - 18			18 - 22		GHz
Gain	11	12.5		11	13.5		11	13.5		dB
Gain Flatness		±0.7			±0.5			±0.5		dB
Gain Variation Over Temperature		0.012			0.008			0.008		dB/ °C
Input Return Loss		13			15			15		dB
Output Return Loss		12			16			13		dB
Output Power for 1 dB Compression (P1dB)	26	28		25	27		23.5	25.5		dBm
Saturated Output Power (Psat)		29.5			29			27		dBm
Output Third Order Intercept (IP3)		39			37			35		dBm
Noise Figure		3.5			4			6		dB
Supply Current (Idd) (Vdd= 10V, Vgg1= -0.8V Typ.)		400	440		400	440		400	440	mA

** Adjust Vgg1 between -2 to 0 V to achieve Idd = 400 mA typical.*

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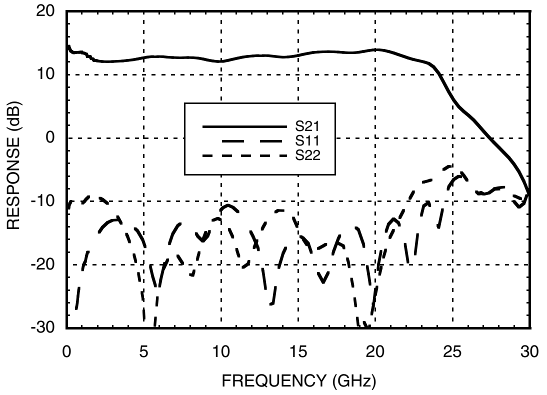
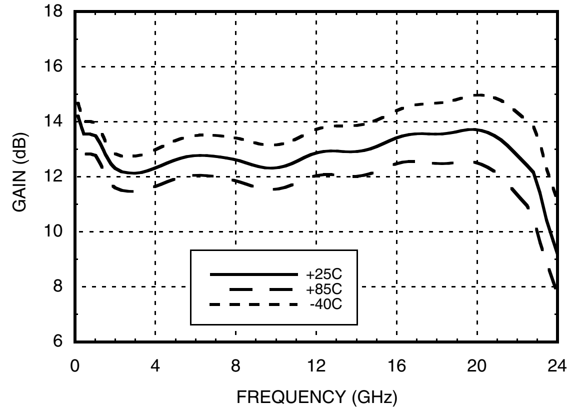
GaAs pHEMT MMIC
1 WATT POWER AMPLIFIER, DC - 22 GHz

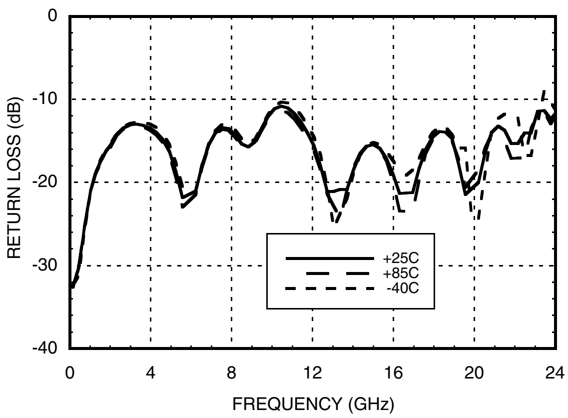
Gain & Return Loss



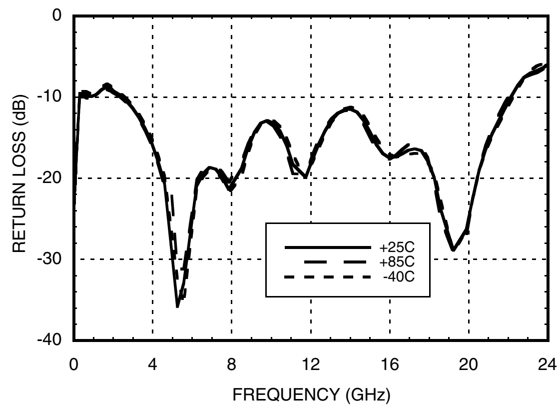
Gain vs. Temperature



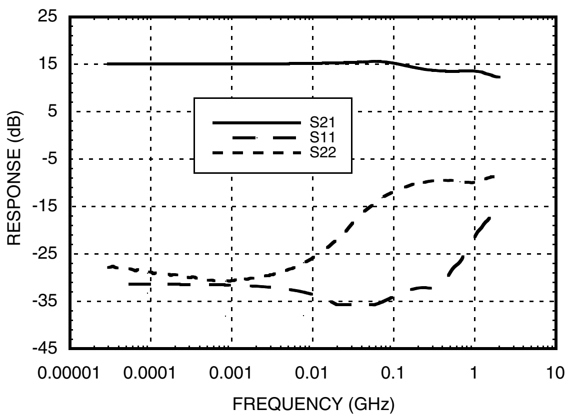
Input Return Loss vs. Temperature



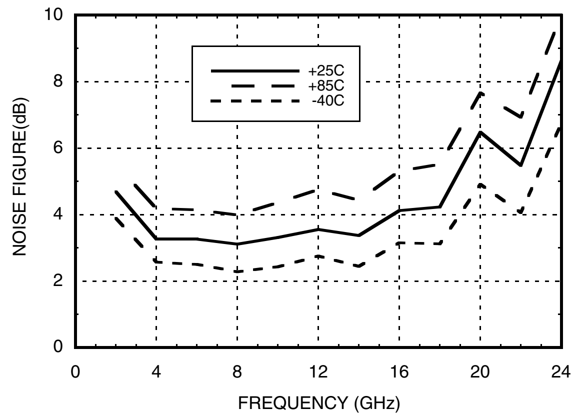
Output Return Loss vs. Temperature



Low Frequency Gain & Return Loss



Noise Figure vs. Temperature



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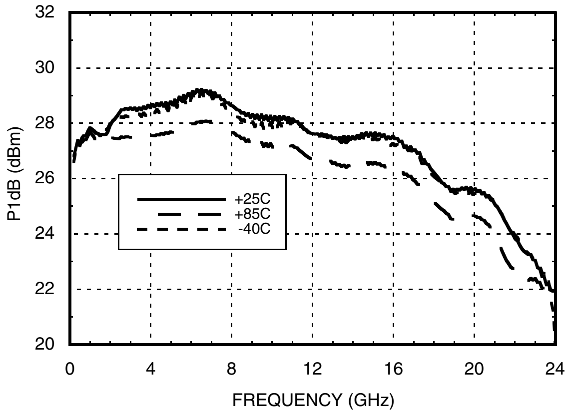
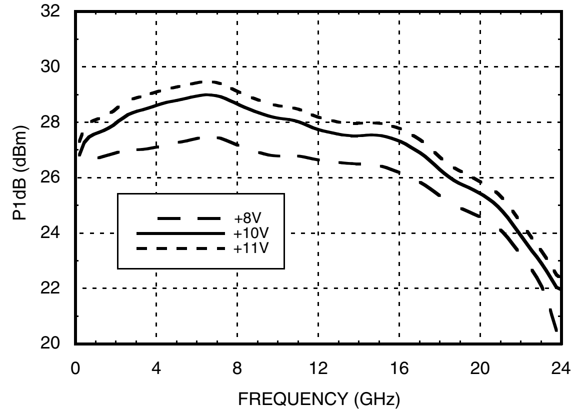
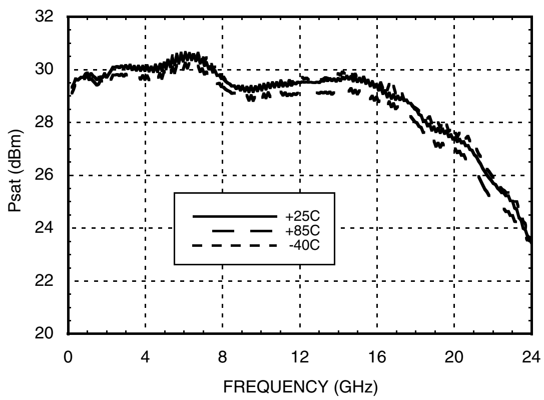
P1dB vs. Temperature



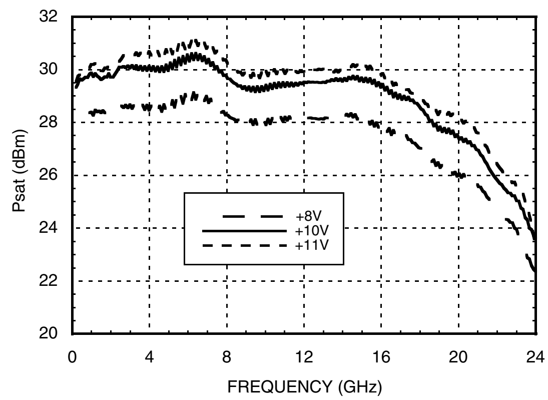
P1dB vs. Supply Voltage



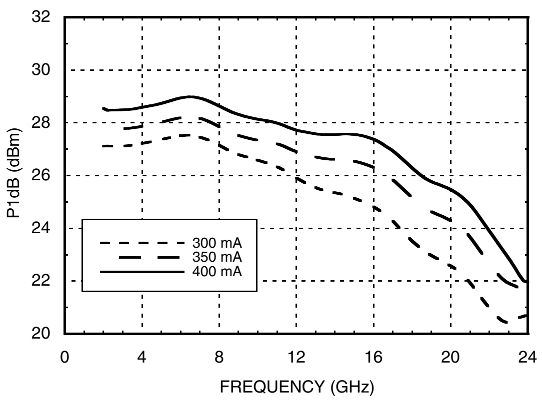
Psat vs. Temperature



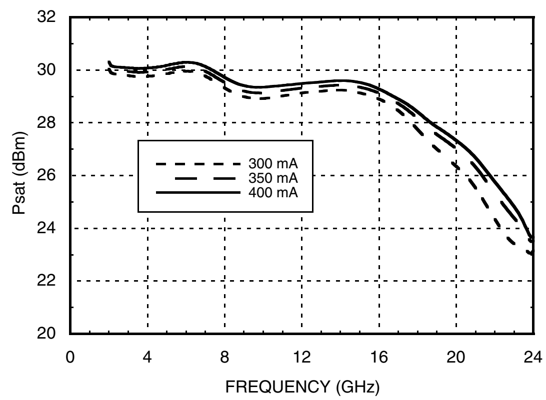
Psat vs. Supply Voltage



P1dB vs. Supply Current



Psat vs. Supply Current



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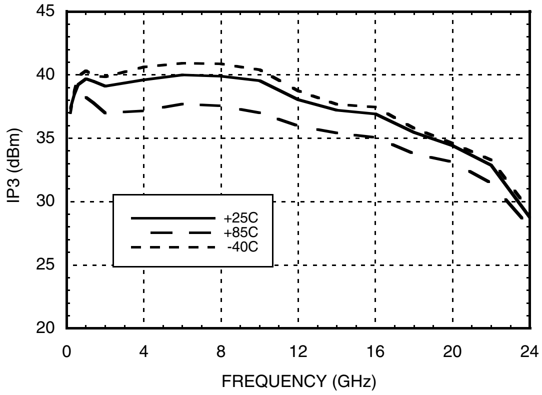
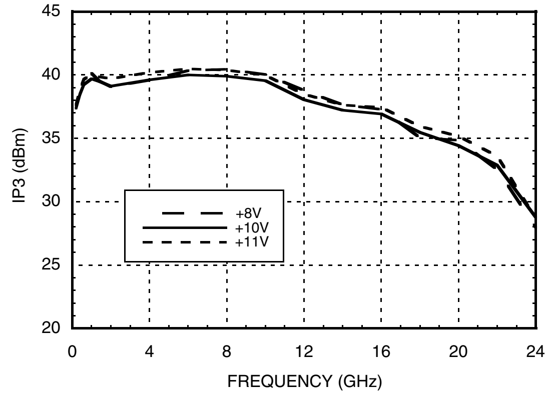
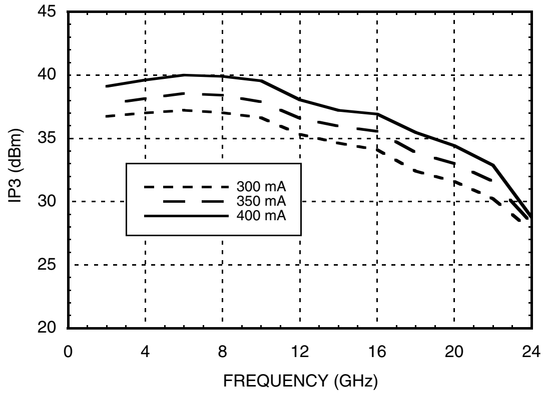
Output IP3 vs. Temperature @ Pout = 18 dBm / Tone



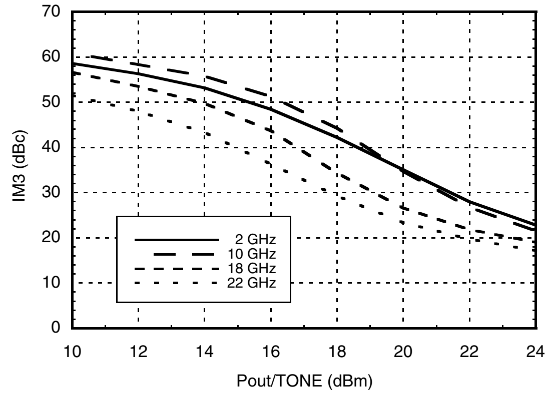
Output IP3 vs. Supply Voltage @ Pout = 18 dBm / Tone



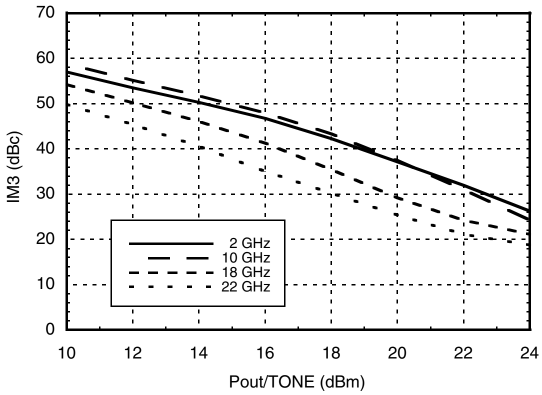
Output IP3 vs. Supply Currents @ Pout = 18 dBm / Tone



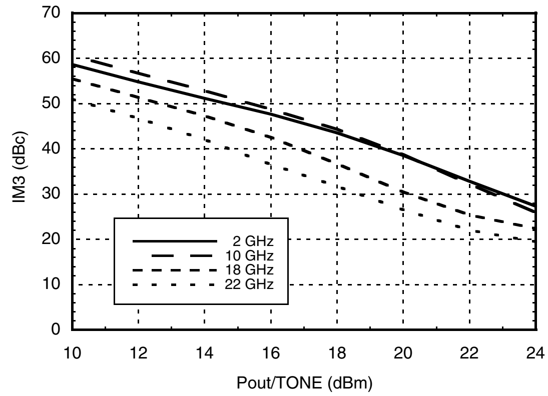
Output IM3 @ Vdd = +8V



Output IM3 @ Vdd = +10V



Output IM3 @ Vdd = +11V



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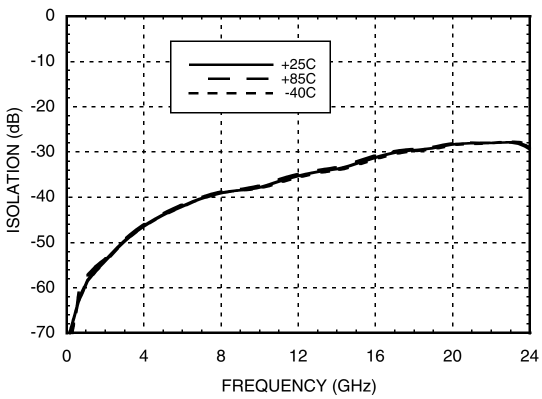
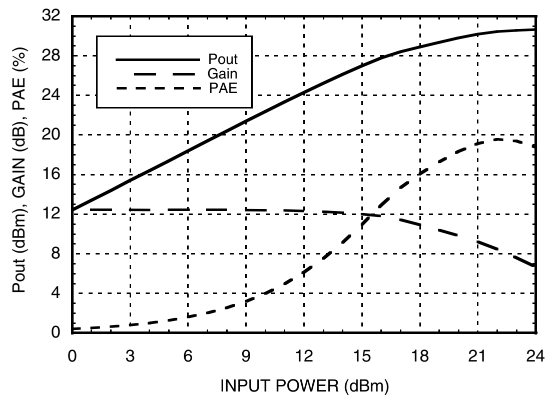
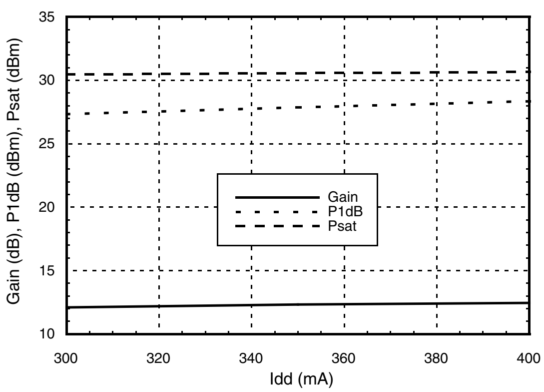
Reverse Isolation vs. Temperature



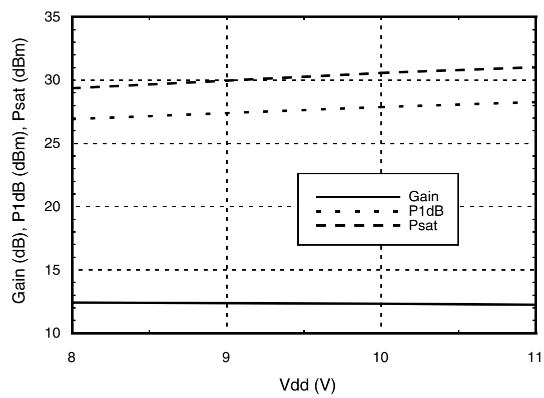
Power Compression @ 10 GHz



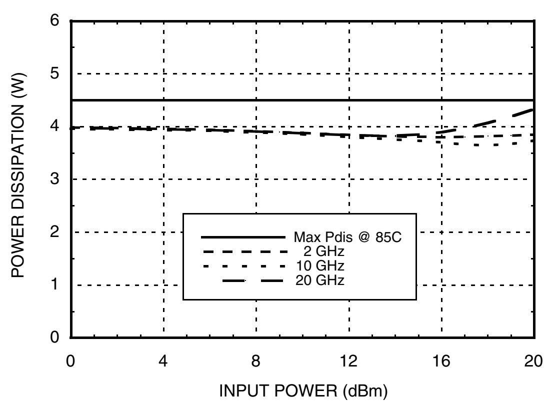
Gain & Power vs. Supply Current @ 10 GHz



Gain & Power vs. Supply Voltage @ 10 GHz



Power Dissipation



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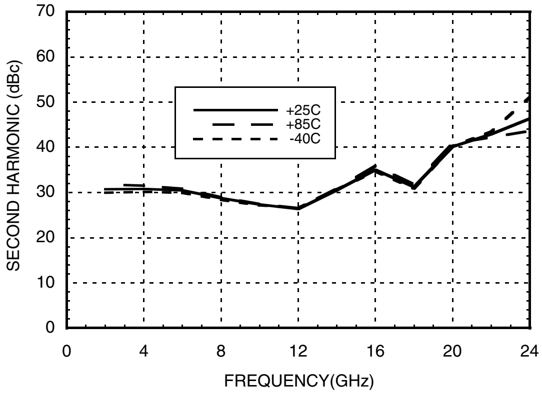
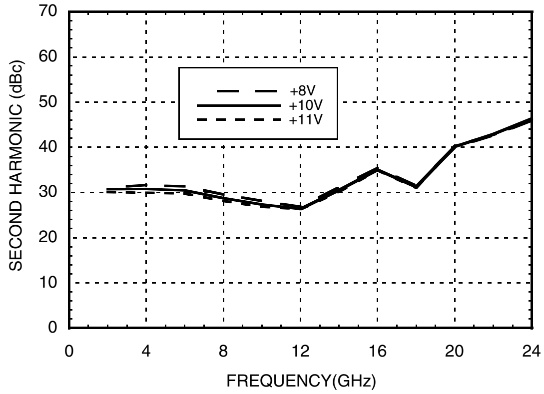
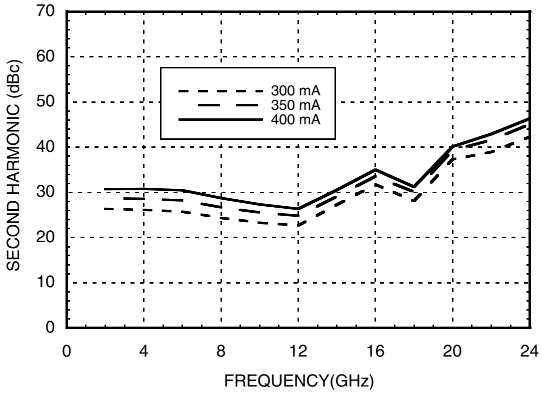
Second Harmonics vs. Temperature @ Pout = 18 dBm, Vdd = 10V & Vgg = 3.5V



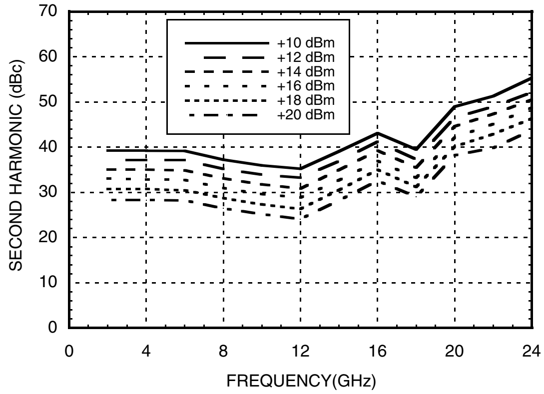
Second Harmonics vs. Vdd @ Pout = 18 dBm, Idd = 400 mA [1]



Second Harmonics vs. Idd @ Pout = 18 dBm, Vgg2 = 3.5V



Second Harmonics vs. Pout Vdd = 10V & Vgg = 3.5V & Idd = 400 mA



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RoHS EARTH FRIENDLY

Absolute Maximum Ratings

Nominal Drain Supply to GND	+12.0 V
Gate Bias Voltage (Vgg1)	-3.0 to 0 Vdc
Gate Bias Current (Igg1)	< +10 mA
Gate Bias Voltage (Vgg2)	+2.0 V to (Vdd - 6.5 V)
Gate Bias Current (Igg2)	< +10 mA
Continuous Pdiss (T= 85 °C) (derate 69 mW/°C above 85 °C)	4.5 W
RF Input Power	+27 dBm
Output Power into VSWR >7:1	+29 dBm
Storage Temperature	-65 to 150 °C
Max Peak Reflow Temperature	260 °C
ESD Sensitivity (HBM)	Class 1A

Reliability Information

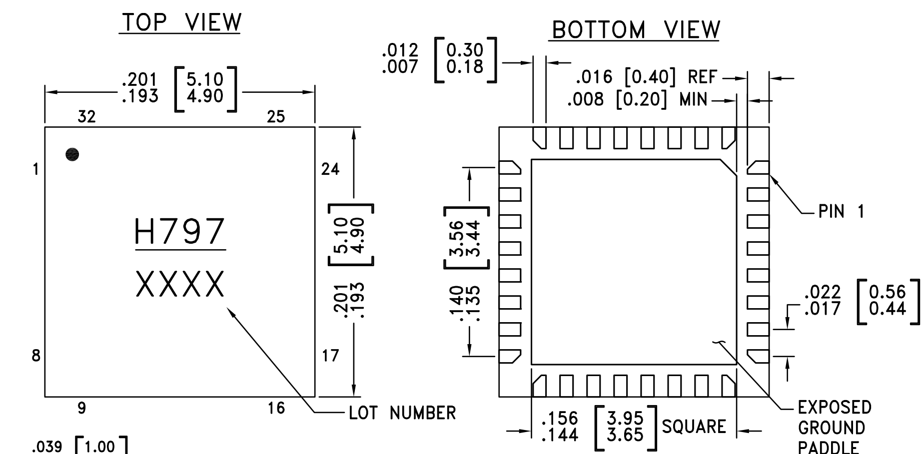
Junction Temperature to Maintain 1 Million Hour MTTF	150 °C
Nominal Junction Temperature (T=85 °C, Vdd = 10 V)	144 °C
Thermal Resistance (channel to ground paddle)	14.6 °C/W
Operating Temperature	-40 to +85 °C

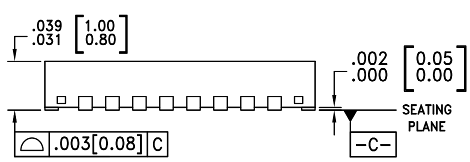
Typical Supply Current vs. Vdd

Vdd (V)	Idd (mA)
+9	400
+10	400
+11	400

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing





NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [1]
HMC797LP5E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H797 XXXX

[1] 4-Digit lot number XXXX
[2] Max peak reflow temperature of 260 °C

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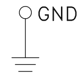
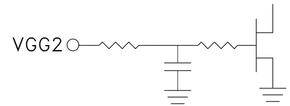
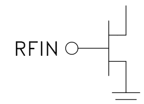
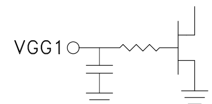
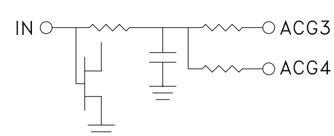
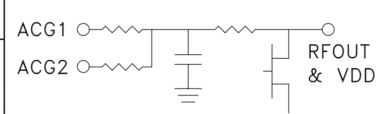
Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 4, 6, 8, 9, 17, 20, 22, 24, 25, 32 Package Bottom	GND	These pins & exposed ground paddle must be connected to RF/DC ground.	
2	VGG2	Gate control 2 for amplifier. Attach bypass capacitor per application circuit herein. For nominal operation +3.5V should be applied to Vgg2.	
3, 7, 10 - 12, 14, 18, 19, 23, 26 - 28, 31	N/C	No connection required. These pins may be connected to RF/DC ground without affecting performance.	
5	RFIN	This pad is DC coupled and matched to 50 Ohms. Blocking capacitor is required.	
13	VGG1	Gate control 1 for amplifier. Attach bypass capacitor per application circuit herein. Please follow “MMIC Amplifier Biasing Procedure” application note.	
15	ACG4	Low frequency termination. Attach bypass capacitor per application circuit herein.	
16	ACG3		
21	RFOUT & VDD	RF output for amplifier. Connect DC bias (Vdd) network to provide drain current (Idd). See application circuit herein.	
29	ACG2	Low frequency termination. Attach bypass capacitor per application circuit herein.	
30	ACG1		

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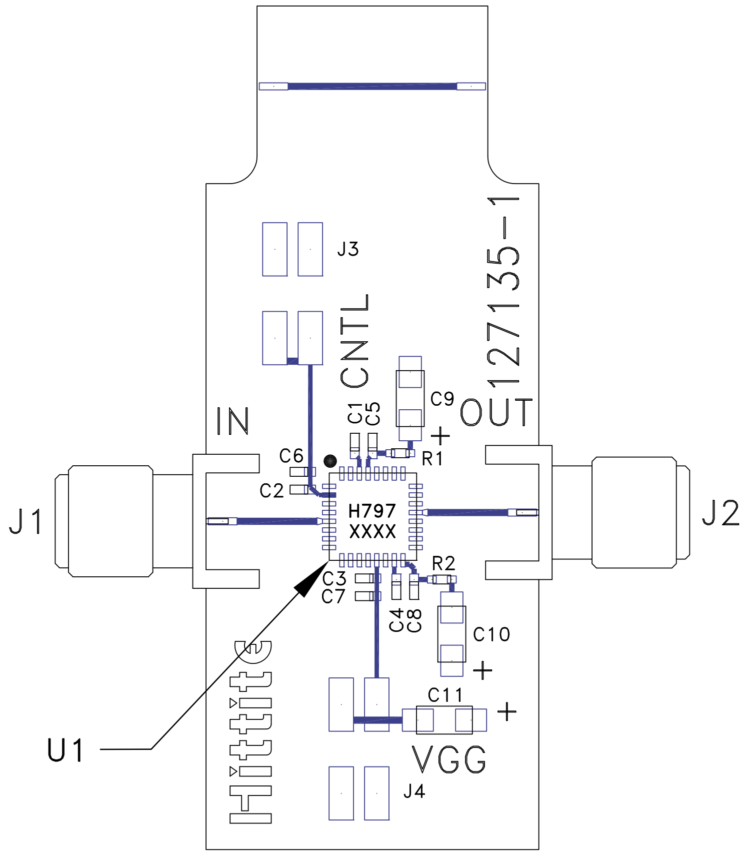
Evaluation PCB



List of Materials for Evaluation PCB 130784 [1]

Item	Description
J1, J2	SMA Connectors
J3, J4	DC Pins
C1 - C4	100 pF Capacitor, 0402 Pkg.
C5, C8	10 kpF Capacitor, 0402 Pkg.
C9 - C11	4.7 µF Capacitor, Tantalum
R1, R2	0 OHM Resistor, 0402 Pkg
U1	HMC797LP5E Power Amplifier
PCB [2]	127135 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon FR4

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.

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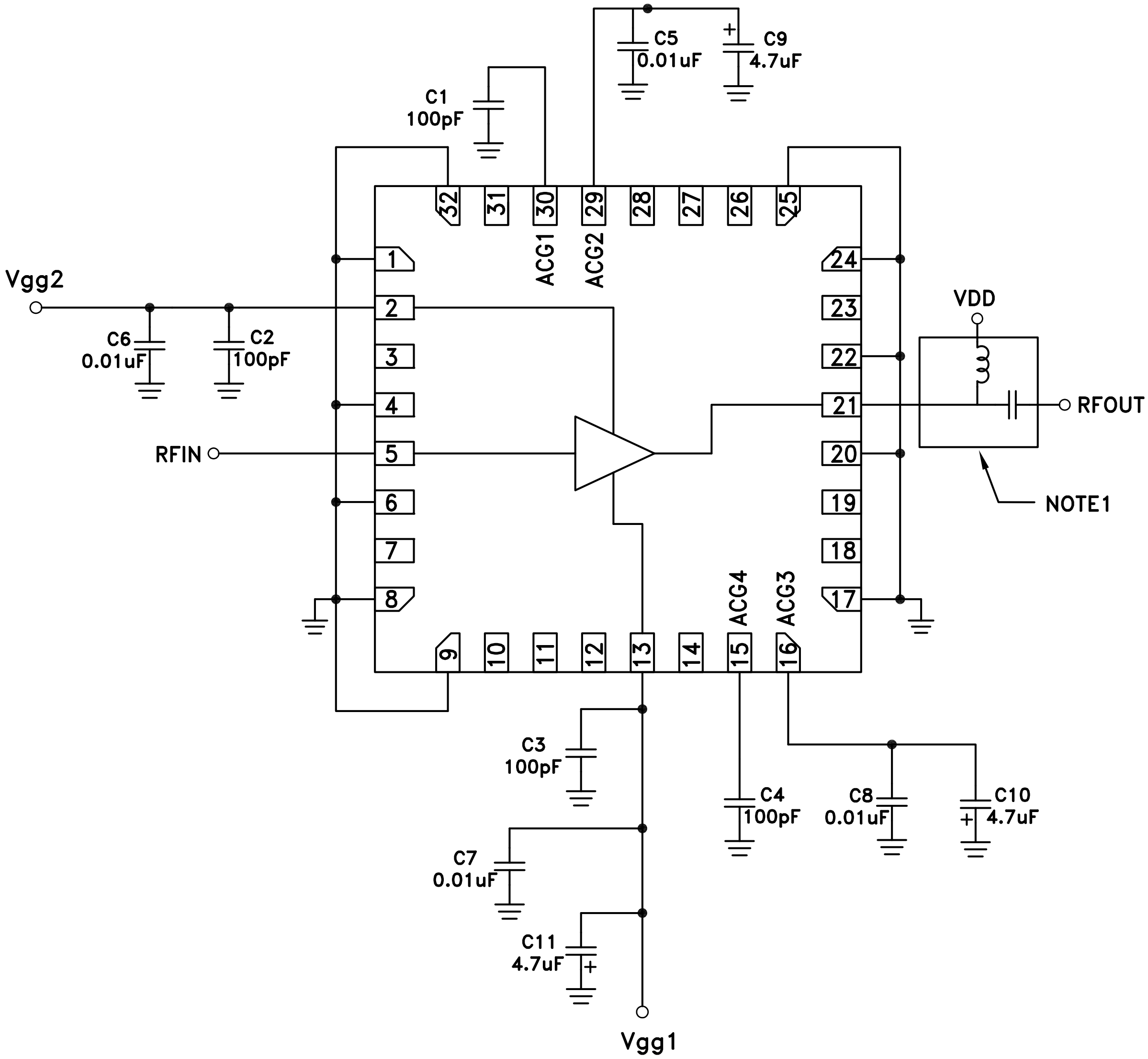
Application Circuit



NOTE 1: Drain Bias (Vdd) must be applied through a broadband bias tee or external bias network.

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